The Beagle, Records of the Museums and Art Galleries of the Northern Territory, 1999 **15**: 1-21

HYDROIDS (HYDROZOA: ANTHOATHECATA) FROM THE BEAGLE GULF AND DARWIN HARBOUR, NORTHERN AUSTRALIA

JEANETTE E. WATSON

Honorary Associate, Invertebrate Zoology, Museum of Victoria, Melbourne VIC 3000, AUSTRALIA
(e-mail jewatson@bigpond.com)

ABSTRACT

Nine species of athecate hydroids collected in two surveys in the Northern Territory of Australia include a new species of *Ralpharia* Watson, 1980, and a new record of *Corydendrium parasiticum* (Linnaeus, 1767) from Australia. Other species in the collection are known from warm temperate to tropical world regions including Western Australia and Queensland, the Timor Sea and Torres Strait.

KEYWORDS: Hydroids, Anthoathecata, Beagle Gulf, Darwin Harbour, northern Australia.

INTRODUCTION

This paper reports upon athecate hydroids collected in two surveys conducted in the Beagle Gulf of the Northern Territory of Australia.

The Beagle Gulf is a large, open embayment of the Australian mainland on the Timor Sea between Melville Island and Bathurst Island (Fig. 1). A survey of the invertebrate fauna of the western side of Anson Bay (13° 29.64' S, 129° 51.00' E) to the eastern side of Cape Hotham (12° 12.36' S, 131° 23.22' E) in Beagle Gulf was undertaken in October 1993 by the Northern Territory Conservation Commission. The survey included 162 stations sampled by dredging in water depths of 4-39 m. The Port of Darwin (12° 28' S, 130° 51' E) is situated in Darwin Harbour, an extensive inlet in Beagle Gulf. The hydroid fauna living on port structures, natural reef and soft bed was intensively collected by the author using SCUBA in August, 1998.

The physical regime of Beagle Gulf is tropical with a water temperature range of 23°-33° C. Water depths are relatively shallow throughout the region, lithology of the seabed varying from sandstone reefs, isolated coral outcrops, loose shale, coarse sand, silt and mud. Strong tidal currents of 50-100 cm/sec (1-2 knots), rising to 4 knots in narrow passages, carry fine sediment throughout the gulf region, resulting in high water turbidity.

Both the wide-ranging Beagle Gulf survey and the more intensive Darwin Harbour survey recovered a rich hydroid fauna. This paper reports upon the anthoathecate species in the collection. Leptothecate hydroids will be reported upon in a later paper.

Other than brief reports on some hydroids collected at Cape Jaubert, Western Australia (Jäderholm 1916) and Torres Strait (Busk 1852, Kirkpatrick 1890), little is known of the north-western and northern Australian hydroid fauna ranging from the warm temperate-tropical water confluence at Shark Bay in Western Australia to Torres Strait in the north (Watson 1996), a distance of some 7,000 km.

The athecate hydroids in the two collections include eight known species and one species of *Ralpharia* Watson, 1980, described here as new. The finding of *Corydendrium parasiticum* (Linnaeus, 1767) is a new record for Australia; three species (*Eudendrium kirkpatricki* Watson, 1985, *Eudendrium infundibuliforme* Kirkpatrick,

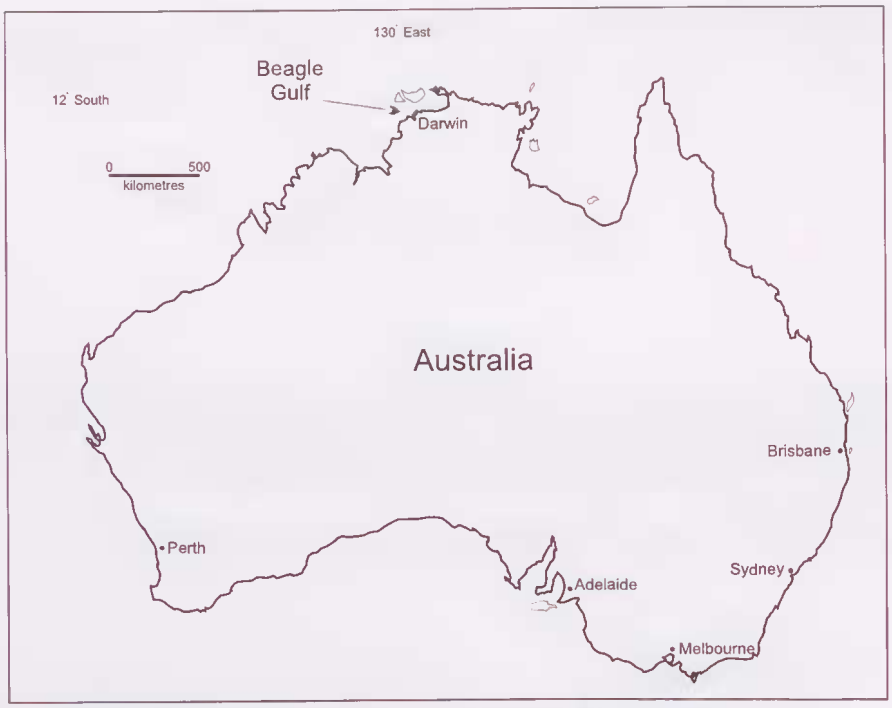

Fig. 1. Map of mainland Australia showing location of Beagle Gulf and Darwin.

1890, *Cladocoryne floccosa* Rotch, 1871) are previously known from the Timor Sea and Torres Strait region, four species (*Bougainvillia ?balei* Stechow, 1924, *Eudendrium glomeratum* Picard, 1951, *Cladocoryne floccosa, Pennaria disticha* Goldfuss, 1820) have been previously recorded from the central western coast of Western Australia, and two species (*Eudendrium kirkpatricki, Solanderia secunda* (Inaba, 1892)) from warm temperate to tropical Queensland. *Corydendrium parasiticum, Cladocoryne floccosa* and *Pennaria disticha* are widely distributed in warm temperate to tropical seas; the latter two also being known from New Zealand, and *Eudendrium glomeratum* is known from the Mediterranean Sea and the British Isles.

MATERIAL AND METHODS

Material collected by the Beagle Gulf survey was fixed in a 10% formaldehyde solution in seawater on board boat and later sorted by staff at the Museum and Art Gallery of the Northern Territory, Darwin. Specimens collected by the author in Darwin Harbour were sealed in containers *in situ*, and (depending on species) immediately preserved on board boat in a 10% solution of formaldehyde in seawater or 70% ethanol.

Descriptions are from preserved material. Type and voucher specimens are lodged in the Museum and Art Gallery of the Northern Territory, Darwin (NTM C) and voucher specimens are lodged in the Museum of Victoria, Melbourne, Australia (MVF).

SYSTEMATICS

Order Filifera
Family Clavidae McCrady, 1859
Genus *Corydendrium* P.J. van Beneden, 1844
Corydeudrium parasiticum (Linnaeus, 1767)
(Fig. 2A-E)

Sertularia parasitica Linnaeus, 1767: 1315.

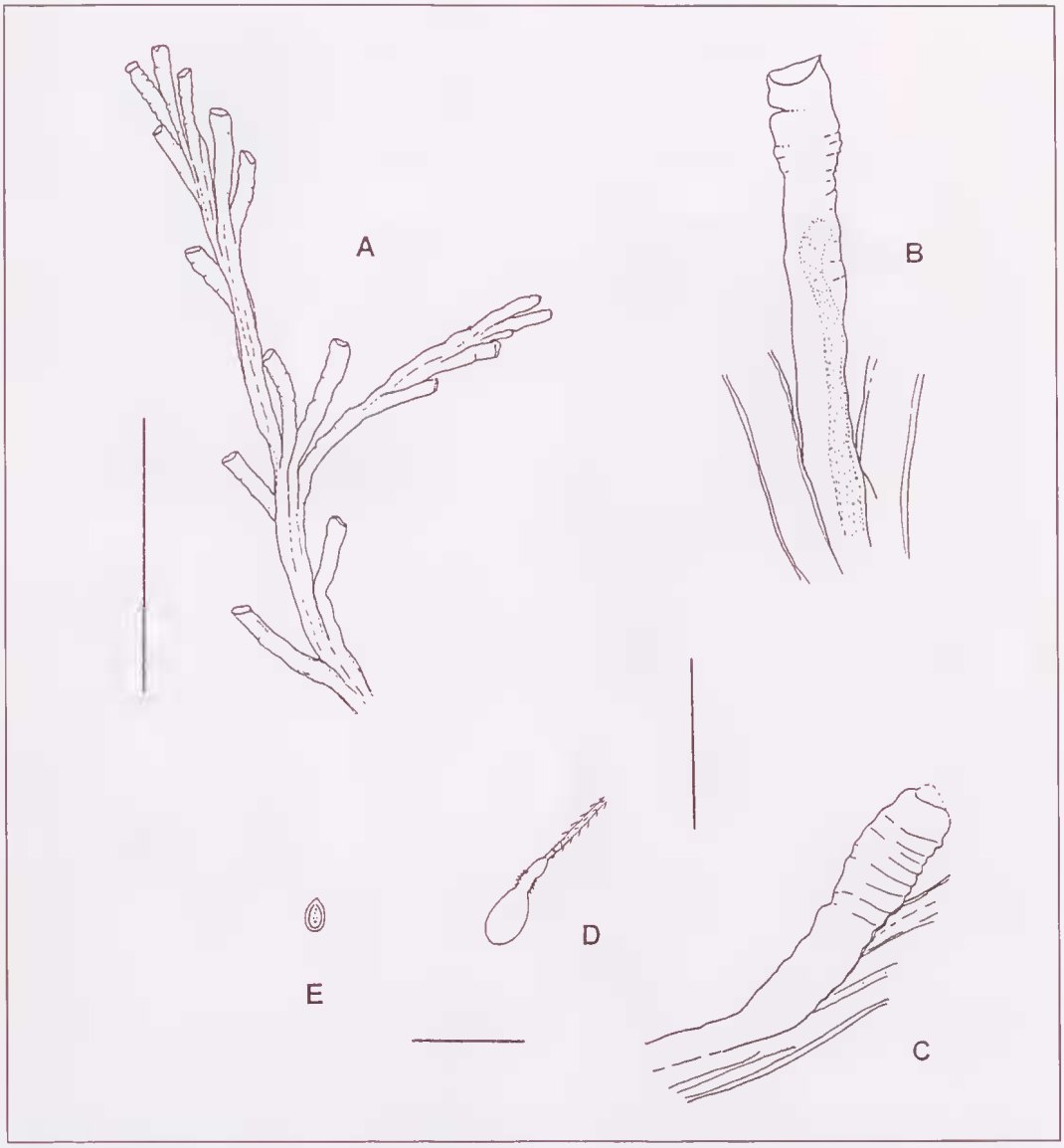

Fig. 2. *Corydendrium parasiticum*: **A**, distal branches of colony; **B**, **C**, distal ends of branches; **D**, microbasic eurytele; **E**, ?desmoneme. Scale bar: A, 5 mm, B, C, 1 mm; D, E, 20 µm.

Soleniopsis dendriformis Ritchie, 1907: 495.

Corydendrium parasiticum - Vervoort 1946: 292; - Millard 1959: 301; - Hirohito 1969: 1; - Millard and Bouillon 1973: 27; - Millard 1975: 72; - Hirohito 1983: 9; - Rees; and Vervoort 1987: 12; - Calder 1988: 6; - Hirohito 1988: 66; - Ramil and Vervoort 1992: 16; - Migotto 1996: 11.

Records and material. NTM C12586, Anson Bay, 13° 25.02' S, 129° 55.98' E, 16 m, 1/10/1993; bottom, fine silt; one colony of three infertile stems, the longest 80 mm high, detached from substrate. NTM C12587; outer Charles Point, 12° 16.08' S, 130° 40.98' E, 28 m, 13/10/1993; bottom, sandy mud; two small, infertile colonies on worm tubes.

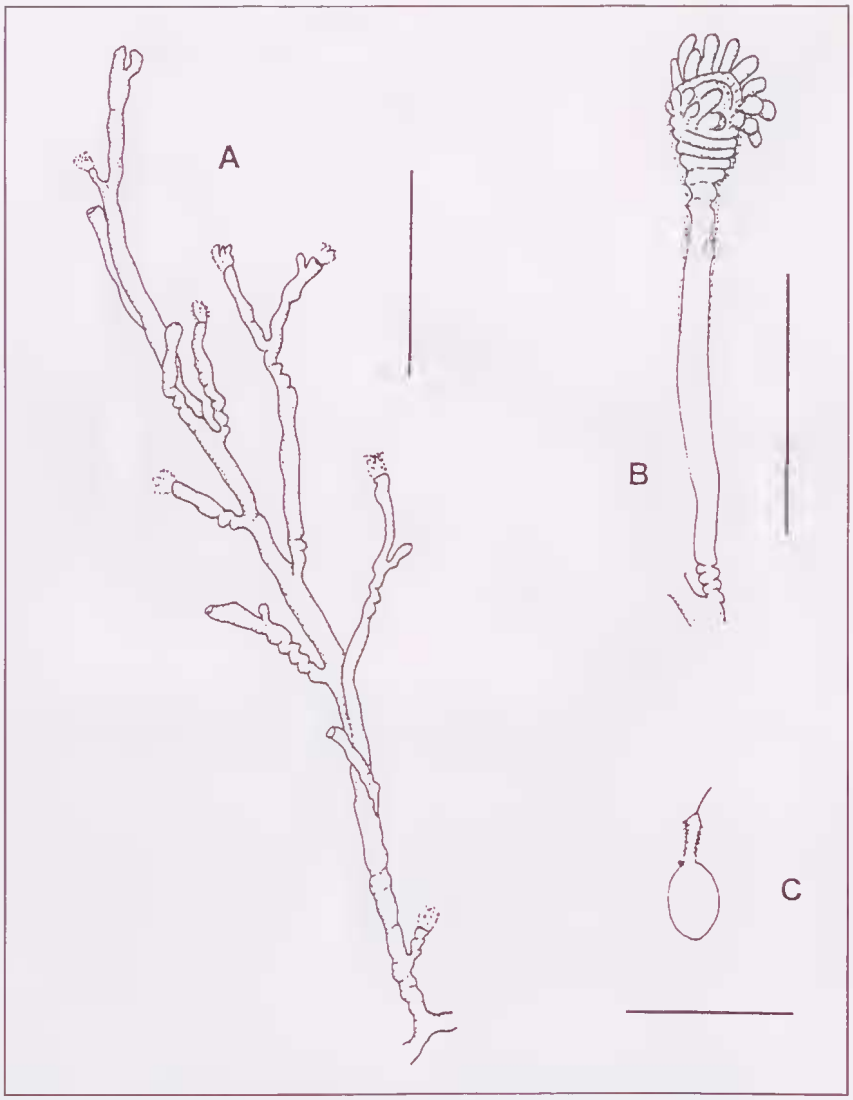

Fig. 3. *Bougainvillia ?balei*: **A**, branched colony; **B**, hydranth; **C**, eurytele. Scale bar: A, 1 mm, B, 0.5 mm, C, 20 µm.

Description. Stems consisting of a bundle of fascicled, irregularly branched hydrocauli; branching of three orders more or less in same plane by forking of perisarc tubes. Adnate tubes proximally narrow, free part diverging at an acute angle to stem; perisarc thick, wrinkled, corrugated to almost smooth. Hydranths with approximately 20 long tentacles scattered over body.

Cnidome. 1) microbasic euryteles in tentacles, capsule 9.5-10.5 x 4.5-6.5 µm, shaft 7 µm, tubule proximally thick with spirals of fine spines; few discharged, not common (Fig. 2D).

2) ?desmonemes, capsule ovoid, 5 x 4.5 µm; rare, none discharged, not common (Fig. 2E).

Colour. Pale honey brown.

Measurements (mm).

Perisarc tube, free length	1.25 - 1.75
Diameter at tube rim	0.3 - 0.6

Remarks. The colonies are covered by adventitious material, chiefly sponge spicules, and some epizooites. Marginal rims

of most tubes are crushed but were probably circular. Remnants of a thin opercular flap are visible within some tubes. The hydranths are too poorly preserved for detailed description. The cnidome generally agrees with that of *Corydendrium parasiticum* from Bermuda (Calder 1988).

Distribution. *Corydendrium parasiticum* is widely distributed in temperate and tropical seas (Rees and Vervoort 1987). Although recorded from the Indo-Pacific it has not previously been reported from the Australian coast.

Family Bougainvilliidae Lesson, 1830
***Bougainvillia* Lesson, 1830**
***Bougainvillia ?balei* Stechow, 1924**
(Fig. 3A-C)

Bougainvillia balei Stechow, 1924: 58. - Stechow 1925: 199, fig. B; - Watson 1996: 78.

Record and material. NTM C12588; outer Charles Point, 12° 25.84' S, 130° 37.86' E, 27 m, 13/10/1993; bottom, sandy mud; one infertile colony of many short, branched and simple stems on *Thyroscyphus*; hydrorhiza intergrown with that of *Synthecium* colony.

Description. Main stems slender, unfasciculated, arising from a creeping ramified hydrorhiza. Branching irregularly alternate, secondary branching common, branches usually arising at an acute angle to stem; diameter of stem and branches almost the same but branches widening a little distally to base of hydranth. Perisare of stems and branches thick, wrinkled to almost smooth, bases of stems and most branches with up to four irregular annulations; perisare invested in a gelatinous sheath, thinner on main stem and lower region of branches, becoming thicker distally, continuing over hydranth to base of tentacles as a thick pseudohydrotheca. Hydranth terminal on branch, with 14-18 tentacles, hypostome conical.

Cnidome. Nematocysts all microbasic euryteles, capsule ovoid, no size classes distinguishable; capsules ranging from 5.5-11 x 4.5-8 µm long, shaft of larger nematocysts 5 µm (none fully discharged). Larger nematocysts concentrated in tips of tentacles; others scattered throughout hydranth.

Colour. Pale brown.

Measurements (mm).

Branched stem, height	8
diameter at base	0.08
maximum length branch	0.50 - 2.25
diameter at origin of branch	0.05 - 0.08
Hydranth	
diameter below tentacles	0.12 - 0.25

Remarks. On colony morphology alone the species could well be referred to *Bougainvillia macloviana* (Lesson, 1830). However, the cnidome is different from the desmonemes and microbasic euryteles of *B. macloviana* described by Millard (1975). No desmonemes were found in the present material and no distinct size classes of euryteles could be identified, the only size difference being that the larger ones tended to be concentrated in the tips of the tentacles.

I have examined alcohol-preserved material, assumed to be type, labelled "*Bougainvillia* (?) *balei* Stechow *auf Lytoscyphus fruticosus* (Esper) von Heirisson Prong, Sharks Bai, Westaustralien, 11 - 12 m tief. 18.vi.1905. det. E. Stechow", kindly loaned by the Zoologische Staatssammlung, Munich, Germany. The two small stem fragments of *Thyroscyphus fruticosus* bear no *Bougainvillia* so the existence of any type material of *B. balei* is in doubt. Hence conspecificity of the Beagle Gulf specimen with *B. balei* cannot be firmly established. However, on the basis of trophosomal similarities with Stechow's figure and its association with *Thyroscyphus*, the Beagle Gulf specimen is doubtfully referred to *B. balei*.

Distribution. Previously known from the type locality of Shark Bay, Western Australia.

Family Eudendriidae L. Agassiz, 1862
***Eudendrium* Ehrenberg, 1834**
***Eudendrium kirkpatricki* Watson, 1985**
(Fig. 4A-D)

Eudendrium kirkpatricki Watson, 1985: 194.

Records and material. NTM C12589; outer Shoal Bay, 12° 6.90' S, 130° 49.92' E, 18 m, 12/10/1993; sponge bed; one infertile colony of several stems 4-19 mm high on

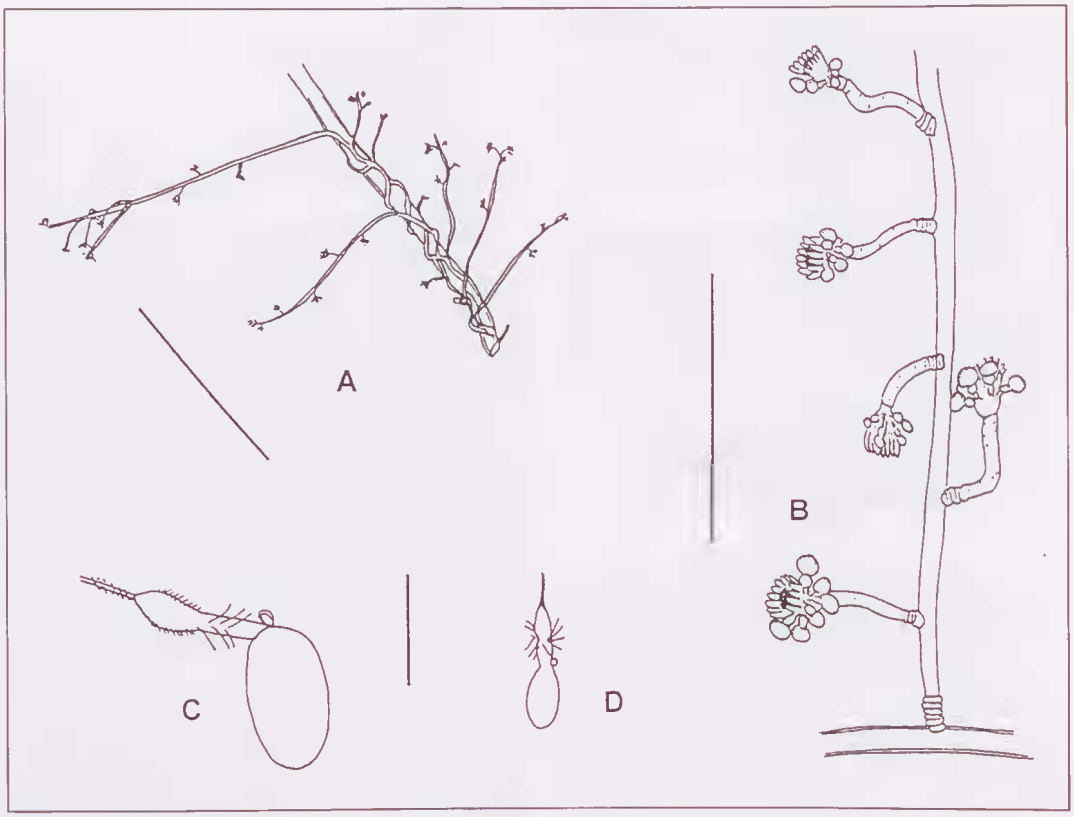

Fig. 4. *Eudendrium kirkpatricki*: **A**, simple colony from Shoal Bay; **B**, part of branched stem from Darwin Harbour; **C**, microbasic eurytele size class 1 from hydranth body; **D**, microbasic eurytele size class 2 from tentacles. Scale bar: A, 1 cm, B, 3 mm, C, D, 10 µm.

dead alcyonarian. NTM C12591, W of Quail Island, 12° 16.08' S, 130° 22.92' E, 9 m, 6/10/1993; bottom coarse sand and gravel; one infertile stem 12 mm high with several hydranths, detached from substrate. NTM C12592, Darwin, offshore reefs, East Point, 4-6 m, coll: J. E. Watson, 19/8/1998; abundant colonies to 50 mm long on alcyonarians, octocorals and sponge. NTM C12590, NNE of North Peron Island, 13° 0.96' S, 130° 4.96' E, 13 m, 4/10/1993; bottom, mud, shale and sand; one infertile stem 10 mm high with two hydranths, detached from substrate.

Description. Colonies from Darwin consisting of tangled, hand-sized tufts of stems arising from ramified hydrorhizae. Hydrocauli of same diameter as hydrorhiza, junction with hydrorhiza marked by several annulations, hydrocauli sometimes lightly fascicled by stolons creeping up stems; stems sparingly branched, origins of branches annulated, perisarc smooth and shining, hydranth pedicels given off at various angles around stem, indistinctly ridged, diameter increasing imperceptibly to base of hydranth; hydranth with 26-28 tentacles.

Male and female gonophores on separate colonies, male two-chambered, bead-shaped, borne on a short peduncle on a blastostyle with fully formed hydranth; female subspherical, borne on blastostyle below hydranth.

Colony from Shoal Bay straggling, monosiphonic, stems arising from a creeping hydrorhiza; tallest stem sparingly branched; most simple, the few remaining hydranths too poorly preserved for description.

*Cnidome.*1) large microbasic euryteles, capsule bean-shaped, 28-33 x 13-15 µm, shaft 20 µm, discharges sideways; on body of hydranth, not numerous (Fig. 4C).

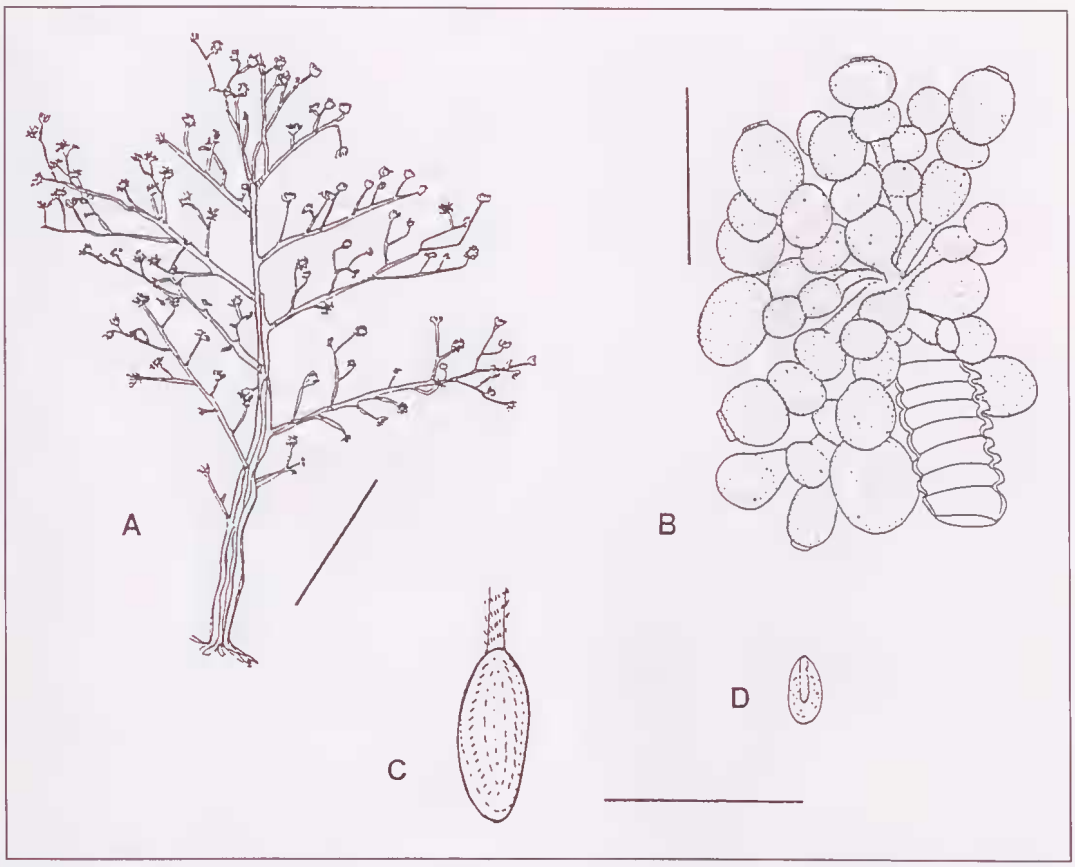

Fig. 5. *Eudendrium glomeratum*: **A**, colony from Chambers Bay; **B**, male gonophores; **C**, ?macrobasic eurytele from hydranth; **D**, microbasic eurytele from tentacles. Scale bar: A, 1 cm, B, 1 mm, C, D, 20 µm.

2) small microbasic euryteles, capsule ovoid, 10-11 x 5-6 µm, shaft about same length as capsule, armed with numerous spines; discharges in axis of capsule, tubule at least 60 µm long; numerous, arranged in circlets around tentacles (Fig. 4D).

Colour. Hydrorhiza and stems shining brown, living hydranths and gonophores creamy-white.

Measurements (mm). (Darwin Harbour specimens)

Stem, width at base	0.30 - 0.35
Hydranth pedicel	
length	0.5 - 2.4
proximal width	0.15 - 0.20
distal width	0.2 - 0.3
Male gonophore	
width across cluster	1.0 - 1.4
length of chain	0.50 - 0.58

Remarks. The luxuriant, fascicled mature colonies from Darwin, occurring on a wide variety of substrates, bear little resemblance to the small, straggling, monosiphonic colonies in the Beagle Gulf collection. The male gonophore has not previously been figured.

The microbasic euryteles are a little larger than previously described for *E. kirkpatricki* by Watson (1985).

Distribution. *Eudendrium kirkpatricki* is one of the most widely distributed species of *Eudendrium* in tropical Australia (Watson 1985).

Eudendrium glomeratum Picard, 1951
(Fig. 5A-D)

Eudendrium glomeratum Picard, 1951:

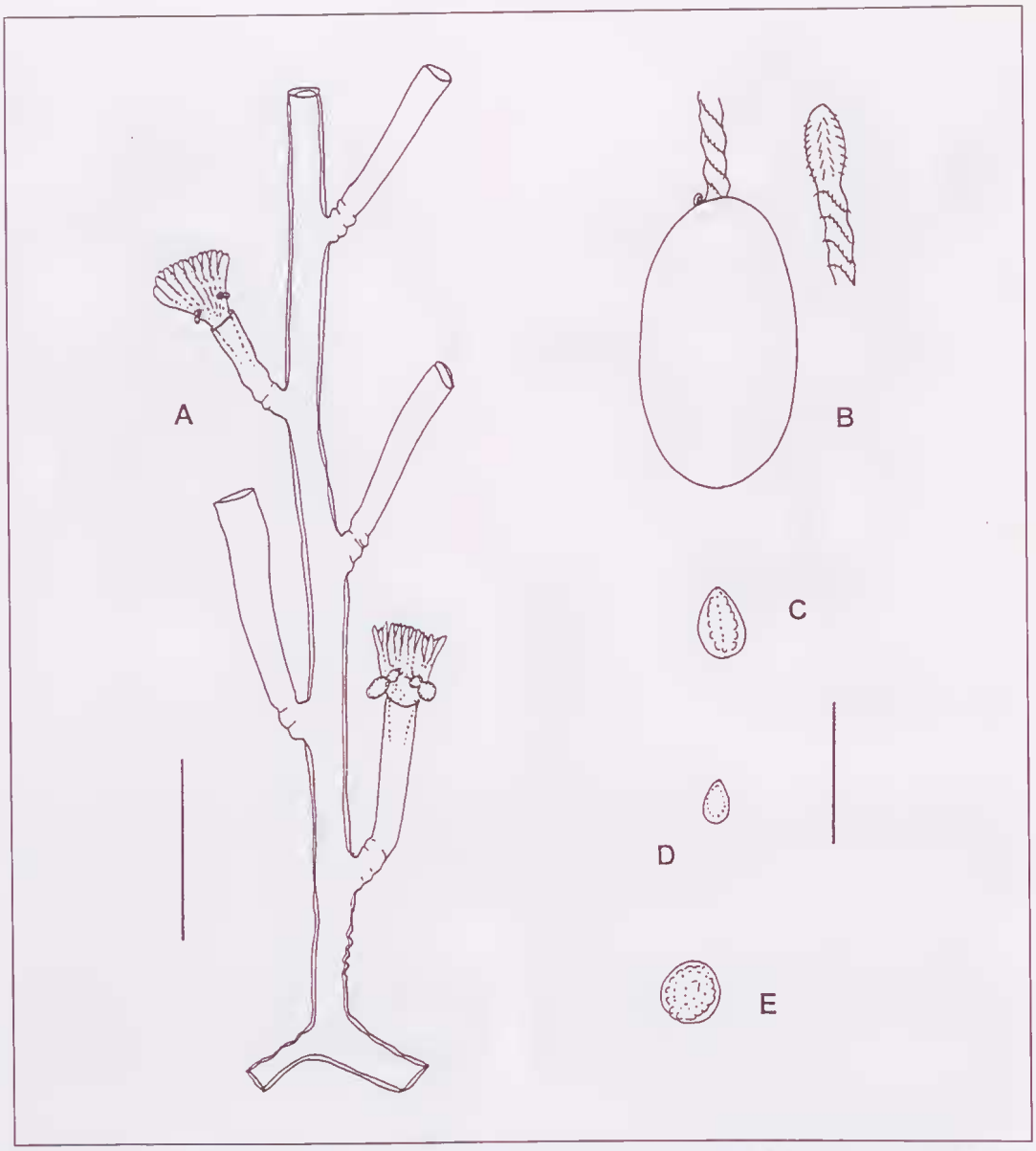

Fig. 6. *Eudendrium infundibuliforme*: **A**, part of small stem with hydrorhiza; **B**, large macrobasic euytele from body of hydranth; **C**, **D**, ?microbasic euryteles, size classes 2 and 3 respectively; **E**, unidentified nematocyst. Scale bar: A, 1 mm, B-E, 20 µm.

338. - Picard 1955: 183; - Rossi 1961: 73. - Teissier 1965: 14; - Fey 1969: 391; - Watson 1985: 213; - Boero *et al.*, 1986: 81; - Boero and Cornelius 1987: 244; - Medel and López-González 1996: 194; - Watson 1996: 78.

Eudendrium generalis von Lendenfeld, 1885, 351. - Thornely 1904: 110; - Jäderholm 1916: 3.

Eudendrium indopacificum Stechow, 1924: 59.

Records and material. NTM C12593, W of Ruby Island, Chambers Bay, 12° 7.08' S, 131° 20.04' E, 22 m, 9/10/1993; bottom, shale and coral rubble; large male colony of about 20 stems to 6 cm high on calcareous bryozoan. NTM C12594; outer Shoal Bay, 12° 6.90' S, 130° 49.92' E, 18 m,

12/10/1993; sponge bed; one stem 35 mm high, detached from substrate.

Description. Hydrorhiza a ramified stolon entwining substrate. Hydrocaulus straight, tubular, fascicled proximally, polysiphonic tubes running about halfway up main stem and for a short distance along some branches. Branching alternate, almost planar, one order of rebranching frequent, three to five indistinct annulations at origin of each branch. Hydranths borne on pedicels of varying length, perisarc annulated, thin and transparent, base of hydranth frequently with a distinct groove just above junction with pedicel, several nematocyst pads distributed around body of most hydranths.

Male gonophores clustered on blastostyle, hydranth completely resorbed; gonophore of three linear bead-shaped chambers on a short peduncle.

Cnidome. 1) large ?macrobasic euryteles, capsule bean-shaped, 34-36 x 11-12 µm, grouped in pads around hydranth body above groove and on gonophores; none fully discharged (Fig. 5C).

2) microbasic euryteles, capsule ovoid, 11.5 - 15 x 4.5 - 7 µm, abundant in tentacles; none discharged (Fig. 5D).

Colour. Main stems dark shining brown, branches paler brown, hydranths and gonophores pale cream.

Measurements (mm).

Stem, width at base		2
Pedicel length	1.0	- 3.5
Gonophores		
width across cluster	2.8	- 3.1
length of chain	1.0	- 1.3

Remarks. The material generally conforms with the description of *E. glomeratum* from north-western Australia by Watson (1985). However, the nematocysts of the present material are considerably larger than previously reported.

Being similar in size and habit, infertile colonies of *Eudendrium kirkpatricki* and *E. glomeratum* are easily confused. In fertile material the distinction between male colonies is simple as the mature blastostyle of *E. kirkpatricki* retains a fully developed hydranth whereas that of *E. glomeratum* is completely resorbed. This is the first record of a male colony from Australia.

Distribution. *Eudendrium glomeratum* is a common hydroid in the Mediterranean Sea and has been recorded from the British Isles (Boero and Cornelius 1987). The only previous Australian record of the species is from Cape Jaubert in Western Australia (Jäderholm 1916; Watson 1985, 1996).

Eudendrium infundibuliforme Kirkpatrick, 1890

(Fig. 6A-E)

Eudendrium infundibuliforme Kirkpatrick 1890: 606. - Pennycuik 1959: 167; - Watson 1985: 211.

Records and material. NTM C12595, NW of Blaze Reef, Fog Bay, 12° 52.02' S, 130° 11.10' E, 6 m, 4/10/1993; bottom coarse sand and shale; one large male colony 70 mm high, detached from substrate. NTM C12596, Bynoe Harbour, 12° 40.92' S, 130° 33.12' E, 9 m, 7/10/1993; young infertile branched colony 30 mm high, hydranths well preserved, on calcareous bryozoan. NTM C12597, south of Fish Reef, Grose Islands, 12° 27.90' S, 130° 26.70' E, 6 m, 6/10/1993; bottom coarse sand; one infertile colony 18 mm high with one branch, no hydranths, attached to shell grit. NTM C12598, outer Charles Point, 12° 15.84' S, 130° 37.86' E, 27 m, 13/10/1993; bottom sandy mud; one small, unbranched stem 45 mm high, with several developing gonophores.

Description. Largest colony arborescently branched but not in one plane; up to four orders of branching, proximal stems of most colonies polysiphonic, the largest colony strongly fascicled with many tubes, some tubes running onto proximal region of branches.

Hydrorhiza a ramified tubular stolon; simple hydrocauli and polysiphonic tubes of fascicled stems of same diameter as hydrorhiza. Stems and branches straight; obscurely annulated at intervals, hydrothecal pedicels alternate, usually directed upwards, pedicel with up to five indistinct proximal annulations, funnel-shaped, widening distally to hydranth. Hydranths too poorly preserved for description.

Male gonophores two-chambered, borne in a circlet on blastostyle with unreduced hydranth; poorly preserved.

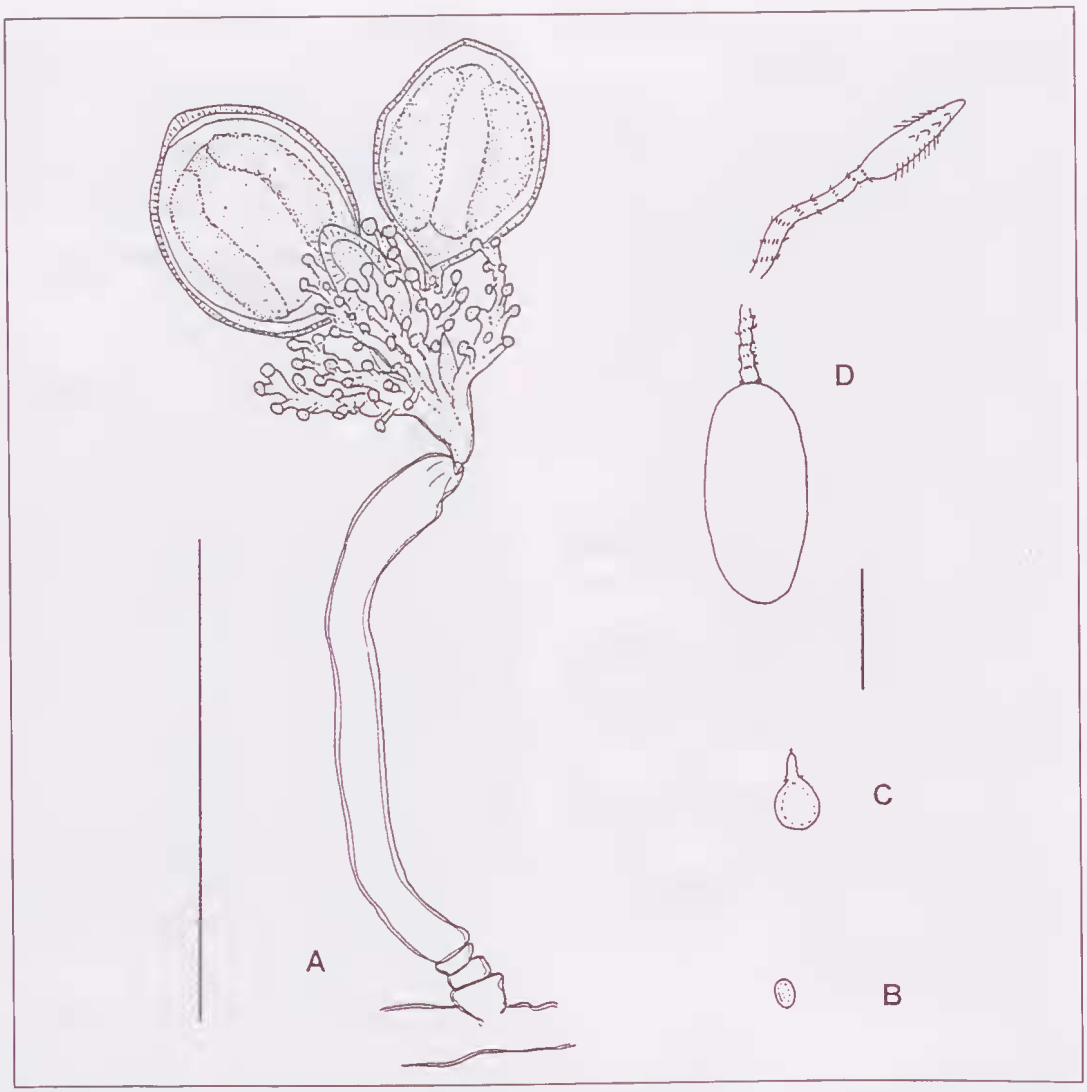

Fig. 7. *Cladocoryne floccosa*: **A**, fertile hydranth; **B**, **C**, ?stenoteles; **D**, macrobasic eurytele from capitate tentacles. Scale bar: A, 1 mm, B-D, 20 µm.

Cnidome. Four types of nematocysts, all poorly preserved.

1) macrobasic euryteles, capsule bean-shaped 37-42 x 21-22 µm, tubule at least 300 µm long, armed with spirals of bristles along length, head slightly inflated, spinous; several on body of hydranth (Fig. 6B).

2) ?microbasic euryteles, capsule ovoid, 7-9 x 4.5-7 µm, in tentacles, none discharged (Fig. 6C).

3) very small ?microbasic euryteles, 5-6 x 3.5 µm, rare in tentacles, none discharged (Fig. 6D).

4) unidentifiable bodies - ?nematocysts, capsule subspherical, none clearly seen, 9-12 x 7 - 10 µm; none discharged, common in tentacles (Fig. 6E).

Colour. Perisarc brown, hydranths white.

Measurements (mm).

Stem, branch diameter	0.2 - 0.3
Pedicel	
length	0.5 - 3.1
proximal diameter	0.12 - 0.19
distal diameter	0.19 - 0.33

Remarks. The specimens conform to the description of *Eudendrium infundibuliforme*

by Watson (1985). The distally expanding hydranth pedicels are diagnostic of the species. Other than confirming Watson's (1985) suggestion that the male gonophores are two-chambered, their poor state of preservation precludes further description. Only a few of the very large euryteles from the hydranth body are discharged and the remainder of the cnidome is too poorly preserved for adequate description. Both size classes of euryteles are larger than previously reported by Watson (1985) for *E. infundibuliforme*. There is no previously recorded counterpart for the putative tentacular nematocysts (4) in the Beagle Gulf specimens.

Distribution. Torres Strait (Kirkpatrick 1890), Papua New Guinea, Great Barrier Reef, Australia (Watson 1985).

Order Capitata

Family Cladocorynidae Allman, 1872

***Cladocoryne* Rotch, 1871**

***Cladocoryne floccosa* Rotch, 1871**

(Fig. 7A-D)

Cladocoryne floccosa Rotch 1871: 228. - Vervoort 1941: 190; - Pennycuik 1959: 159; - Millard and Bouillon 1974: 11; - Bouillon 1974: 145; - Millard 1975: 65; - Watson 1996: 95; - Schuchert 1996: 97.

Cladocoryne haddoni Kirkpatrick, 1890: 605.

Cladocoryne pelagica Allman 1876: 255. - Stechow and Müller 1923: 459; - Stechow 1925: 193.

Record and material. NTM C12599, E of Blaze Reef, Fog Bay, 12° 51.96' S, 130° 14.10' E, 7 m, 4/10/1993; bottom mud and shale; one colony of many sparingly fertile stems on the hydroid *Idiellana pristis*.

Description. Stems simple, up to 2 mm high, perisarc with a few proximal annulations, smooth thereafter, thinning a little and tapering below hydranth. Hydranth with several whorls of branched tentacles bearing many globular capitula armed with nematocysts; hypostome clavate. Gonophores large, globular, borne among oral tentacles.

Cnidome. 1) ?stenoteles, capsule subspherical, diameter 5-7 µm, very abundant, none discharged (Fig. 7B).

2) ?stenoteles, capsule subspherical, 11-12 x 10-12 µm, shaft 8 µm, indistinct, abundant (Fig. 7C).

3) macrobasic eurytcles, capsule 66-75 x 25-30 µm, tubule long, thick, unarmed proximally, with distal spirals of spines and spear-shaped tip armed with spines; in capitate tentacles (Fig. 7D).

Colour. Preserved material white.

Remarks. The material conforms to descriptions of this distinctive species. The smaller nematocysts in the cnidome correspond with measurements given by Millard (1975); however, the macrobasic euryteles are much larger and the distal end of the tubule differs from the thread-like end shown in Milliard's figure.

Distribution. Widely distributed in tropical and subtropical waters, sometimes extending into cooler seas, e.g. New Zealand (Schuchert 1996), Port Phillip Bay, southern Australia (Watson, pers. obs.). In the Australian region it is known from Queensland (Pennycuik 1959) to Shark Bay on the western side of the continent (Stechow 1925) and from the Timor Sea (Stechow and Müller 1923).

Family Tubulariidae Fleming, 1828

***Ralpharia* Watson, 1980**

***Ralpharia rosetta* sp. nov.**

(Fig.8A-G)

Records and material. HOLOTYPE, NTM C12606, East Point, Darwin, reef 700 m from shore, 6 m, coll: J. E. Watson 17/8/1998; one fertile colony on worm tube growing on coral rock.

Description. Hydrorhiza entwining substrate, tubular, contorted, perisarc very thick, some stolons attached to lower regions of hydrocauli.

Hydrocaulus tubular, of greater diameter than hydrorhiza, straight or curved, circular in section, hollow, increasing in diameter distally from base, 10-12 narrow longitudinal internal canals all of similar diameter, visible through perisarc; perisarc thinning over length of stem, merging into an indistinctly transversely wrinkled transparent sheath beneath hydranth, a groove separating distal end of hydrocaulus from base of hydranth.

Fig. 8. *Ralpharia rosetta*, sp. nov.: **A**, fertile hydranth; **B**, blastostyle with male gonophores; **C**, **D**, stenoteles, size classes 1 and 2 respectively; E, anisorhiza from apical cluster of gonophore; **F**, ?isorhiza from base of aboral tentacles; **G**, desmoneme. Scale bar: A, 5 mm, B, 2 mm, C-F, 20 µm.

Hydranth pyriform, base broad with a whorl of about 40 long aboral tentacles and 20 tightly clustered short oral tentacles; aboral tentacles well separated from orals by a long coelenteric region.

Gonophores male, up to 20 on a long, slender, unbranched blastostyle: gonophores spherical, some flattened apically. Distal end of blastostyle a tight rosette of small, quadrate nematophores richly armed with nematocysts.

Cnidome. 1) stenoteles, capsule subsphcrical 7.5-12 x 8-11 µm, shaft 15 µm long with large spines, abundant in oral and aboral tentacles and in apical cluster (Fig. 8C).

2) stenoteles, capsule spherical, diameter 15-17 µm, shaft 20-22 µm, with large spines; scattered abundantly in oral tentacles and apical cluster (Fig. 8D).

3) large anisorhizas, capsule spherical, 15-16 µm diameter, tubule thick and ropy, at least 45 µm long, heavily armed with small spines; very abundant, in nematophore cluster, few discharged (Fig. 8E).

4) ?isorhizas, capsule elongate ovoid, anterior end slightly pointed, 14-19 x 1-7 µm, in base of aboral tentacles, none discharged (Fig. 8F).

5) desmonemes, capsulc 8-9 x 3-4 µm, partially discharged, rare, site unknown (Fig. 8G).

Colour. In life, hydrocaulus pale green, body of hydranth deep orange to gold, aboral tentacles clear white to pale gold, oral tentacles pale gold; gonophores scarlet. Preserved material uniformly white.

Measurements (mm).

Hydrorhiza, diameter	0.5	-	0.75
Hydrocaulus			
length	17	-	30
proximal diameter	0.75	-	1.00
distal diametcr	1.0	-	2.0
Hydranth			
width across extended tentacles			15.0
length of aboral tentacles			5.0
length of oral tentacles			3.0
Gonophore			
length of blastostyle	5	-	7
diameter of gonophore	0.5	-	0.6

Remarks. The class (1) stenoteles exhibit such a large range in size that the extremes could well be assigned to two different size classes.

The hydranths are fertile even when quite young. In life, the aboral tentacles are strongly recurved backward, exposing the gonophores. The function of the distal nematophore cluster mus be defence of the underlying gonophores. Some previously broken hydrocauli show regeneration of stems and regrowth of hydranths.

Petersen's (1990) redefinition of *Ralpharia* Watson, 1980 now encompasses those species with 10-20 canals in the parenchymatic endoderm, one canal being larger than the others, and branched or unbranched blastostyles with or without distal a nematophore cluster. Inclusion of a nematophore now greatly widens the original definition of *Ralpharia* to the extent that critical review of the scope of the genus may be nesessary.

I therefore refer the present species with some hesitation to *Ralpharia*. While *Ralpharia rosetta* is in some respects similar to *Ralpharia neira* Petersen, 1990, from Indonesia, there are fewer endodermal canals and no obvious central canal in the hydrocaulus, nor are the medusa buds borne on dichotomously branched blastostyles as in *R. neira*.

Etymology. Named for the distal rosette-shaped nematophore cluster of the blastostyle.

Family Solanderiidae Marshall, 1892

Solanderia Duchassaing and Michelin, 1846

Solanderia secunda (Inaba, 1892)

(Fig. 9A-F)

Dendrocoryne secunda Inaba, 1892: 98. - Goto 1897: 93; - Stechow 1909: 40; - Stechow 1913: 7; - Bedot 1918: 116; - Stechow 1923: 2; - Bedot 1925: 165; - Prévot 1959: 100, 125; - Yamada 1959: 14.

Solanderia secunda - Vervoort 1962: 526. - Millard 1966: 446; - Vervoort 1966: 387, 389; - Vervoort 1967: 23 -25; - Mergner and Wedler 1977: 11; - Vervoort and Vasseur 1977: 10, 11-15; - Ho 1984: 23, 24, 41, 44; - Hirohito 1988: 49. - Bouillon *et al.*, 1992: 12.

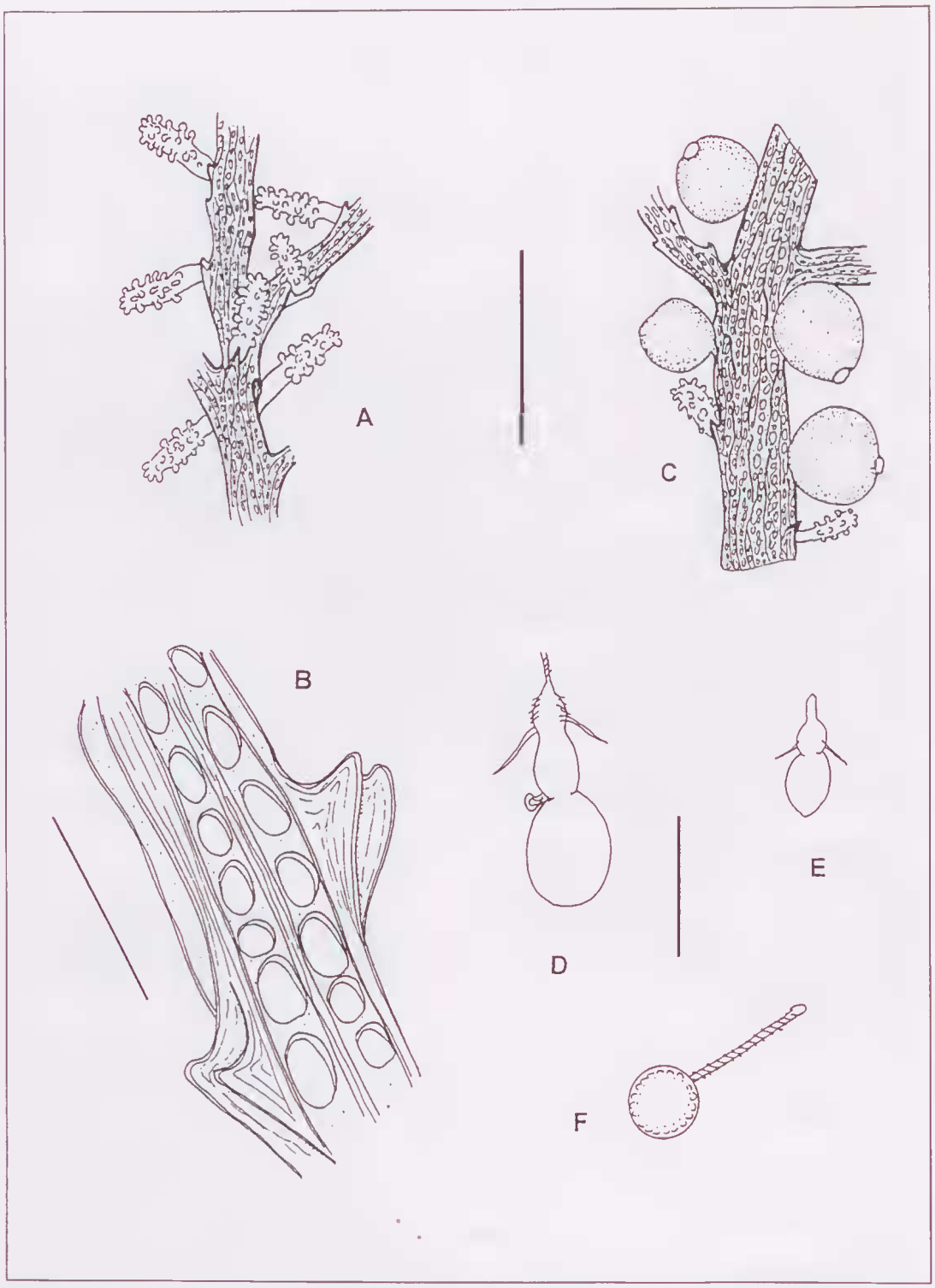

Fig. 9. *Solanderia secunda*: **A**, part of upper branch with hydranths; **B**, young branch with perforations and bracket-like spines; **C**, gonophores; **D**, stenotele of size class 1 from capitala of tentacles; **E**, stenotele size class 2; **F**, ?isorhiza. Scale bar: A, C, 2 mm, B, 0.25 mm, C-F, 20 µm.

Solanderia rufescens Jäderholm, 1896: 5. *Ceratella minima* Hickson, 1903: 114. - Thornely, 1908: 85.

Solanderia minima - Stechow 1909: 41. - Bedot 1925: 413; - Vervoort 1962: 531; - Vervoort 1967: 25, 26; - Millard and Bouillon 1973: 16; - Millard and Bouillon 1974: 3; - Millard 1975: 59; - Mergner and Wedler 1977: 11; - Vervoort 1977: 10; - Bouillon and Gravier-Bonnet 1987: 768.

Ceratella crosslandi Thornely, 1908: 85.

Solanderia crosslandi - Stechow 1909: 41. - Bedot 1925: 412; - Kramp 1947: 6; - Vervoort 1962: 531; - Vervoort 1967: 20,23,24,26; - Vervoort 1977: 11.

Records and material. NTM C12600, SW of Marsh Shoals; outer Shoal Bay, 12° 7.02' S, 130° 52.92' E, 20 m, 12/10/1993; sponge bed; one infertile colony 30 mm high, on shell. NTM C12601, South Shell Island, Darwin; reef in channel bed, 6 m, coll: J. E. Watson, 21/8/1998; two fertile colonies, the tallest 18 cm high, on worm tubes and coral rock. MVF 83436, East Arm Port breakwater, 3-4 m, coll: J. E. Watson, 20/8/1998; one infertile colony 10 cm high.

Description. Hydrorhiza a cluster of stolons strongly entwined around substrate. Colonies arborescently branched in one plane, several main branches arising from a thick, short trunk; trunk of largest colony 4 mm thick near base; in older colonies many orders of branching, the branches thinning to growing tips. Skeletal meshwork on younger branches penetrated by lines of oval to quadrangular perforations aligned parallel to axis of branch, this pattern often obscured in older branches and stem.

Darwin material with a mean of 50 hydranths per cm along length of branch; in life, hydranths large, cylindrical, supported on prominent bicuspid skeletal spines; all tentacles capitate, four oral and 15-20 others scattered over body. Beagle Gulf specimen with no remaining hydranths.

Gonophores male, eumedusoid, large, globular, with four radial canals (not visible in preserved material) and a small raised apical cap; peduncle very short; no nematocysts.

Cnidome. Nematocysts in capitata of tentacles, few discharged:

1) large stenoteles, capsule subspherical, 17-17.5 x 13-14 µm, shaft 25 µm long with several long spines, tubule thick; moderately abundant (Fig. 9D).

2) smaller stenoteles, capsule ovoid, 8.5-9 x 6.5-7 µm shaft (partially discharged) about same length as capsule; tubule not seen; abundant (Fig. 9E).

3) ?isorhizas, capsule subspherical, 10 x 9 µm, tubule 25 µm (partially discharged) finely spinous; rare in some hydranths, absent from others (Fig. 9F).

Colour. Darwin colonies black in situ, under stereo-microscope deep purple, fading to mauve on tips of branches; hydranths white, gonophores scarlet (leaching to white in alcohol), radial canals white. Beagle Gulf colony brown, yellowish on growing tips.

Measurements (mm).

	Darwin	Beagle Gulf
Skeleton length of foramen	0.060 - 0.135	0.065 - 0.115
height of spines	0.06 - 0.22	0.08 - 0.15
Hydranth length	0.75 - 1.25	
Gonophore diameter	0.7 - 1.2	

Remarks. The specimens conform with the concept of *Solanderia secunda* of Bouillon *et al.* (1992) who united two previously separate species (*Solanderia minima* and *Solanderia crosslandi*) with prominent bicuspid hydrophores into forms of *Solanderia secunda*. Their concept encompasses a large morphological range and wide geographical distribution, the f. *typica* being widely known from the Indo-Pacific region while the others have a circumtropical distribution. The present material resembles both f. *crosslandi* from Madagascar and f. *typica* from Papua New Guinea (Bouillon *et al.* 1992).

There is no information available for comparison of the cnidome of *S. secunda* throughout its geographical range. While stenoteles of two sizes are the major components of the cnidome (Bouillon *et al.* 1992 and present material) the larger size class (1) in the Darwin specimens is larger than dimensions given by Bouillon *et al.* for the largest stenoteles (11.2-14.4 x 9-11.2 µm).

The smaller Darwin stenoteles are almost within the same size range as the small stenoteles (6.0-8.6 x 4.0-7.2 µm) given by these authors. Bouillon *et al.* also list unidentified globular nematocysts of 6 x 7 µm which may match the putative isorhizas found in the present material; if so, the Darwin nematocysts are considerably larger. The significance of size ranges of nematocysts in identification of hydroid species is a vexed problem which is not yet properly explored.

Bouillon *et al.* (1992) described the colour of *S. secunda* as varying from purple fading to mauve, or shades of brown fading to yellow-brown on younger branches. The present specimens fall within this colour range, with purple-black colonies up to 25 cm high being abundant on natural reef on the bed of the East Arm Port channel. The small yellow-brown specimen from Beagle Gulf may possibly be the juvenile colour of colonies. The scarlet colour of the Darwin gonophores is distinctive.

Colonies observed on the rock breakwater at East Arm Port, emplaced in March, 1997 were, after 15 months, already up to 10 cm high; indicating a fast rate of growth of the species.

Living hydranths of the Darwin specimens were heavily invested by colonies of the protozoan *Vorticella*.

Distribution. Tropical and subtropical Pacific and Indian Oceans (Bouillon *et al.* 1992).

Family Pennariidae McCrady, 1859
Pennaria Goldfuss, 1820
Pennaria disticha Goldfuss, 1820
(Fig.10A-I)

Pennaria disticha Goldfuss 1820: 89. - Brinckmann-Voss 1970: 40; - Gibbons and Ryland 1989: 387; - Schuchert 1996: 142.

Halocordyle disticha - Pennycuik 1959: 160. - Millard 1975: 41; - Garcüa Corrales and Aguirre 1985: 85; - Calder 1988: 56 (cum. syn.); - Hirohito 1988: 28.

Halocordyle disticha var. *australis* - Stechow 1925: 194; - Vervoort 1941: 192; - Vervoort 1946: 290.

Pennaria australis Bale, 1884: 45; - Trebilcock 1928: 1; - Ralph 1953: 70.

Records and material. NTM C12602, W of Finniss River, Fog Bay, 12° 51.96' S, 130° 16.98' E, 7 m, 4/10/1993; bottom fine mud; one infertile colony of 12 stems to 30 mm high, poorly preserved, detached from substrate. NTM C12603, South Shell Island, Darwin, coll: J. E. Watson, 6 m, 19/8/1998; three stems 50 mm high on shell fragments in channel bed.

Description. Stems plumose, arising from a ramified hydrorhiza; stolons tubular, perisarc very thick, internally longitudinally striated. Hydrocaulus tubular, becoming narrower distally, divided into internodes of variable length by 4-5 deeply indented transverse nodes; hydrocladia distal on internodes, gracefully recurved from stem, up to eight annulations at junction with stem; internodes same as those on stem, one hydranth given off on a short expanding pedicel on upper, distal side of each internode; pedicel indistinctly ringed at base, perisarc thinner than on hydrocladium.

Hydranths clavate to pyriform, terminal hydranth on each hydrocladium usually larger than others, all hydranths with a whorl of 10-14 semi-filiform aboral tentacles and 14-16 scattered pedunculate capitate tentacles on upper body, aboral tentacles with a longitudinal band of nematocysts on outward facing side, peduncle of oral tentacles long, transversely wrinkled, capitilum richly armed with nematocysts. Developing gonophores on young hydranths; too small for description.

Cnidome. 1) stenoteles, capsule ovoid, 45 -46 x 27-30 µm, shaft 58-60 µm, 10 µm wide armed with four or five curved spines 30 µm long spines and spirals of fine bristles, tubule at least 180 µm long; abundant in capitate tentacles (Fig. 10B).

2) stenoteles, capsule ovoid, 37 x 25 µm, shaft 60 µm, tubule at least 60 µm, in capitate tentacles; none discharged, not common (Fig. 10C).

3) stenoteles, capsule ovoid, 15-18 x 13-17 µm, shaft 15-20 µm; in capitate tentacles (Fig. 10D).

4) stenoteles, capsule ovoid, 6.5-10 x 4-7 µm shaft 8 µm, very abundant; in aboral and capitate tentacles, few discharged (Fig. 10E).

5) desmonemes ovoid to pyriform capsules, 6-8 x 4-4.5 µm, in aboral tentacles,

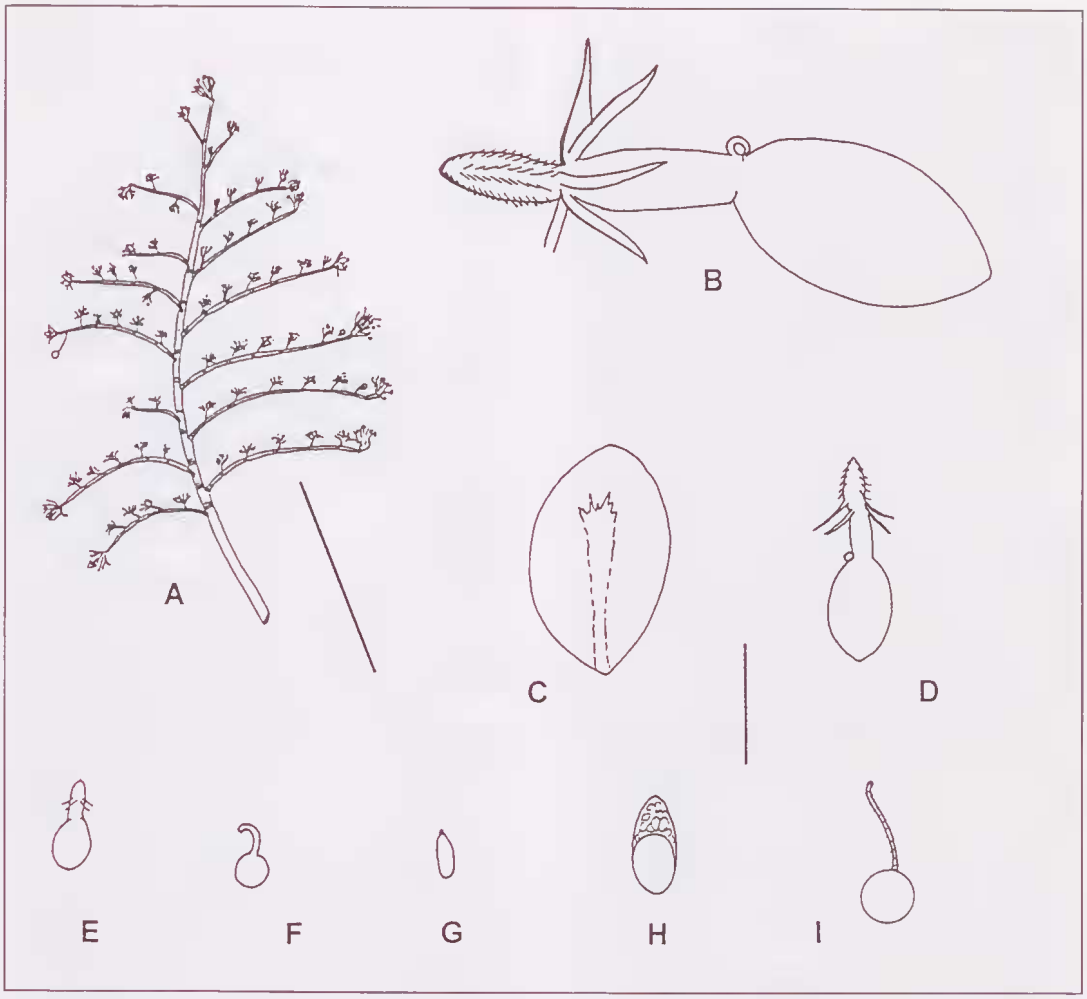

Fig. 10. *Pennaria disticha*: **A**, colony from Darwin Harbour; **B**, **C**, stenoteles size classes 1 and 2 from capitate tentacles; **D**, **E**, stenoteles size classes 3 and 4 from tentacles; **F**, desmoneme; **G**, ?haploneme from aboral tentacles; **H**, nematocyst with inclusion body; **I**, ?isorhiza. Scale bar: A, 1 cm, B-H, 20 µm.

only one seen discharged (Fig. 10F).

6) ?haploneme, capsules small bean-shaped, 9-12 x 3-6 µm; abundant in aboral tentacles, none discharged (Fig. 10 G).

7) capsule ovoid narrower at anterior end, 12.5-15 x 6.5-7 µm with inclusion body; in aboral tentacles, none discharged (Fig. 10H).

8) ?isorhiza capsule almost spherical 10 x 7 µm, site unknown, several partially discharged, tubule with very fine spines (Fig. 10I).

Colour. Stems of Darwin Harbour specimens shining dark brown, hydrocladia lighter brown, hydranths white; Beagle Gulf stems pale brown, hydranths white.

Measurements (mm).

Stem	
internode length	0.55 - 2.00
width at node	0.33 - 0.43
Hydrocladium	
length	1.0 - 12
internode length	1.5 - 2.13
width at node	0.18 - 0.23
Hydranth pedicel	
length	0.23 - 0.48
distal width	0.13 - 0.15

Remarks. Four size classes of stenoteles present in *Pennaria disticha* from Darwin and Beagle Gulf are also recognised in the species from New Zealand (Schuchert 1996), Bermuda (Calder 1988) and the

Mediterranean Sea (Östman *et al.* 1991). However, the actual size ranges within the classes differ between various accounts as well as among the Australian material; for example size class (1) from Darwin is considerably larger than reported from elsewhere. Other than the desmonemes which are invariably present and are of similar size throughout the species' range, haplonemes and heteronemes, including microbasic euryteles, have also been reported by the above authors. In the present material, nematocyst (6), although larger, appears to correspond with haplonеme (b) of Calder. While nematocyst (7) conforms with microbasic curytele (c) of Calder, this type of nematocyst has not been reported by other authors but may correspond with the microbasic b mastigophores with inclusion reported by Östman *et al.* (1991). Isorhiza? (8), although quite common in some hydranths of the present material, has not been recorded by other authors.

The lack of agreement in the type and size of components of the cnidome from four global localities (tropical Australia, New Zealand, Bermuda, Mediterranean Sea) brings into question how much reliance can be placed upon the cnidome in identification of species and the possible disparate response of nematocysts to geographical and environmental factors.

Distribution. Circumglobal tropical to temperate waters; in Australia, southern Queensland (Pennycuik 1959) and Great Barrier Reef (J. E. Watson, pers. obs.)

ACKNOWLEDGMENTS

I thank the Museum and Art Gallery of the Northern Territory for providing the Beagle Gulf collection for examination. Thanks are also due to the Zoologische Staatssammlung, Munich, Germany, for loan of Australian type material, the CSIRO Australia for the opportunity to work with the Centre for Research on Introduced Marine Pests (CRIMP) team in Darwin Harbour, and the Director of the Northern Territory Museum and Art Gallery for provision of accommodation and laboratory facilities during the Harbour survey. Further thanks are due to the referees who gave freely of their time and advice for improvement of the paper.

REFERENCES

Agassiz, L. 1862. *Contributions to the Natural History of the United States of America* **4**: 1-380.

Allman, G. J. 1872. *A monograph of the gymnoblastic or tubularian hydroids.* Vol. 1: 1-450. The Ray Society: London.

Allman, G. J. 1876. Diagnoses of new genera and species of Hydroida. *Journal of the Linnean Society* (Zoology) **12**: 251-284.

Bale, W. M. 1884. *Catalogue of the Australian hydroid zoophytes.* Australian Museum: Sydney.

Bedot, M. 1918. Matériaux pour servir á l'histoire des Hydroïdes, 6éme période (1891 - 1900). *Revue Suisse de Zoologie* **26** (suppl.): 1-376.

Bedot, M. 1925. Matériaux pour servir á l'histoire des Hydroïdes, 7éme période (1901-1910). *Revue Suisse de Zoologie* **32** (suppl.): 1-657.

Boero, F., Balduzzi, A., Bavastrello, G., Caffa, B., and Vietti, R. C. 1986. Population dynamics of *Eudendrium glomeratum* (Cnidaria: Anthomedusae) on the Portofino Promontory (Ligurian Sea). *Marine Biology* **92**: 81-85.

Boero, F., and Cornelius, P. F. S. 1987. First records of *Eudendrium glomeratum* (Cnidaria: Hydroida) in British and Irish waters, and taxonomic comments. *Irish Naturalists' Journal* **22**: 244-246.

Bouillon, J. 1974. Description de *Teissiera milleporoides* nouveau genre et nouvelle espéce de Zancleidae des Seychelles avec une révision des Hydroïdes 'Pteronematoidea'. *Cahiers de Biologie Marine* **15**: 113-154.

Bouillon, J., and Gravier-Bonnet, N. 1987. *Pseudosolanderia picardi*, nouveau genre et nouvelle espéce de Rosalindidae de la Réunion (Anthomedusae, Hydrozoa, Cnidaria). *Bulletin du Muséum National d'Histoire Naturelle* **9**: 755-771.

Bouillon, J., Wouters, K., and Boero, F. 1992. Étude des Solanderiidae de la Baie de Hansa (Papouasie Nouvelle Guinée) avec une révision du genre *Solanderia* (Cnidaria, Hydrozoa). *Bulletin de l'Institut Royal des Sciences Naturalles de Belgique, Biologie* **62**: 5-33.

Brinckmann-Voss, A. 1970. Anthomedusae/ Athecatae (Hydrozoa, Cnidaria) of the

Mediterranean. Part 1. Capitata. *Fauna Flora Golfo Napoli* **39**: 1-96.

Busk, G. 1852. An account of the Polyzoa and Sertularian zoophytes, collected in the voyage of the Rattlesnake, on the coasts of Australia and the Louisiade Archipelago, etc. In: MacGillivray, J., *Narrative of the voyage of H.M.S. Rattlesnake.* Appendix 1: 343-402. London.

Calder, D. R. 1988. Shallow water hydroids of Bermuda. The Athecatae. *Life Science Contributions* **148**: 1-107.

Duchassaing, P, and Michelin, H. 1846. Note sur deux Polypiers de la famille des Coraux, appartenant aux genres *Solanderia* et *Pterogorgia. Revue Zoologique* **9**: 218-220.

Ehrenberg, G. G. 1834. Beiträge zur physiologischen Kenntniss der Corallienthiere in Allgemeinen und besonders des Rothen Meeres. *Abhandlungen der Königliche Akademie der Wissenschaften, Berlin* **1832**: 250-380.

Fey, A. 1969. Peuplements sessiles de l'archipel de Glénan. I - Inventaire: hydraires. *Vie et Milieu* (Series B) **20**: 387-414.

Fleming, J. 1828. *A history of British animals.* Edinburgh, Bell and Bradfute, and London, J. Duncan.

Garcéa-Corrales, P., and Aguirre, A. 1985. La especie *Halocordyle disticha* (Goldfuss, 1820) y sus sinonimias. *Boletin del Instituto Español del Oceanografia* **2**: 85-96.

Gibbons, M. J., and Ryland, J. S. 1989. Intertidal and shallow water hydroids from Fiji. 1. Athecata to Sertulariidae. *Memoirs of the Queensland Museum* **27**(2): 377-432.

Goldfuss, G. S. 1820. *Handbuch der Zoologie*, Erste Abtheilung. Nürnberg: Schrag.

Goto, S. 1897. *Dendrocoryne*, Inaba, Vertreterin einer neuen Familie der Hydromedusen. *Annotationes Zoologicae Japonenses* **1**: 93-104.

Hickson, S. J. 1903. On the Coelenterata collected by Mr. Crossland in Zanzibar. -1. *Ceratella minima*, n. sp. *Proceedings of the Zoological Society of London* **1**: 113-116.

Hirohito. 1969. Some hydroids from the Amakusa Islands. *Biological Laboratory of the Imperial Household, Tokyo* **1969/9**: 1-32.

Hirohito. 1983. Hydroids from Izu Oshima and Niijima. *Biological Laboratory of the Imperial Household, Tokyo* **1983/6**: 1-83.

Hirohito. 1988. *The Hydroids of Sagami Bay.* Biological Laboratory of the Imperial Household, Tokyo.

Ho, J. – S.1984. Copepoda associated with sponges, cnidarians and tunicates of the Sea of Japan. *Report of the Sado Marine Biological Station, Niigata University* **14**: 23-62.

Inaba, M. 1892. Soshu, Miura, Misaki ni oide edaru Hydroidea (Hydroids collected at Miura and Misaki in Soshu). *Zoological Magazine, Tokyo* **4**: 93-101.

Jäderholm, E. 1896. Ueber AussereuropäÏsche Hydroiden des Zoologischen Museums der Universität Upsala. *Kungliga Svenska Ventenskabs Akademiens Handlingar* **21**: 1-20.

Jäderholm, E. 1916. Results of Dr. E. Mjobergs Swedish scientific expeditions to Australia 1910 - 1913. XII. Hydroiden. *Kungliga Svenska Ventenskapsak Akademiens Handlingar* **52**(12): 1-9.

Kirkpatriek, R. 1890. Reports on the zoological collections made in Torres Straits by Professor A. C. Haddon, 1888-1889. Hydroida and Polyzoa. *Proceedings of the Royal Dublin Society* (n.s.) **6**: 603-626.

Kramp, P. L. 1947. Hydroids collected by the "Skagerak" Expedition in the eastern Atlantic 1946. *Göteborgs Kungliga Vetenskapsoch Vitterhets-Samhälles Handlingar* (B6), **5**(8): 1-16.

Lendenfeld, R. von. 1885. The Australian Hydromedusae. II. *Proceedings of the Linnean Society of New South Wales* **9**: 345-353.

Lesson, R. P. 1830. *Voyage autour du monde, exécuté par ordre du roi sur la corvette 'La Coquille', pendant des années* 1822-1825. Zoologie, Paris: Bertrand.

Linnaeus, C. 1758. *Systema naturae.* Ed. 10. Holmiae.

Linnaeus, C. 1767. *Systema naturae.* Ed. 12. Holmiae.

Marshall, W. 1892. *Spongiologische Beiträge. Festschrift zur siebzigsten Wiederkehr des Geburstages von Rudolf Leuckart.* Leipzig.

Mayer, A. G. 1910. *Medusae of the world. Volume II. The Hydromedusae.* Washington.

McCrady, J. 1859. Gymnothalmata of Charleston Harbour. *Proceedings of the Elliot Society of Natural History* **1**: 103-221.

Medel, M. D., and López-González, P. J. 1996. Updated catalogue of the hydrozoans of the Iberian Peninsula and Balearic Islands, with remarks on zoogeography and affinities. In: *Advances in Hydrozoan Biology*, Piraino, S. Boero, F., Bouillon, J., Cornelius, P. F. S., and Gili, J. M. (eds). *Scientia Marina* **60** (1): 183-209.

Mergner, H., and Wedler, E. 1977. Über die Hydroidpolypenfauna des Roten Meeres und seiner Ausgänge. *"Meteor" Forschung Ergebnisse* **24**: 1-32.

Migotto, A. E. 1996. Benthic shallow water hydroids (Cnidaria, Hydrozoa) of the coast of São Sebastião, Brazil, including a checklist of Brazilian hydroids. *Zoologische Verhandelingen* **306**: 1-125.

Millard, N. A. H. 1959. Hydrozoa from the coasts of Natal and Portuguese East Africa. II. Gymnoblastea. *Annals of the South African Museum* **44**: 297-313.

Millard, N. A. H. 1966. The Hydrozoa of the South and West coasts of South Africa. III. The Gymnoblastea and small families of Calyptoblastea. *Annals of the South African Museum* **48**(18): 427-487.

Millard, N. A. H. 1975. Monograph of the Hydroida of South Africa. *Annals of the South African Museum* **68**: 1-513.

Millard, N. A. H., and Bouillon, J. 1973. Hydroids from the Seychelles (Coelenterata). *Annals de Musée Royal de l'Afrique Centrale* **206**: 1-106.

Millard, N. A. H., and Bouillon, J. 1974. A collection of hydroids from Moçambique, East Africa. *Annals of the South African Museum* **65**: 1-40.

Östman, C., Piraino, S. and Kem. W. 1991. Nematocysts of the Mediterranean hydroid *Halocordyle disticha*. *Hydrobiologia* **216/217**: 607-613.

Pennycuik, P. R. 1959. Faunistic records from Queensland. Part V. Marine and brackish water hydroids. *Papers of the Department of Zoology of the University of Queensland* **1**: 141-210.

Petersen, K. W. 1990. Evolution and taxonomy in capitate hydroids and medusae. *Zoological Journal of the Linnean Society* **100**: i-xvii, 101-231.

Picard, J. 1951. Note sur les Hydraires littoraux de Banyuls-sur-Mer.*Vie et Milieu* **2**: 338- 349.

Picard, J. 1955. Hydraires des environs de Castiglione (Algérie). *Bulletin de la Station d'Aquiculture et de Péche de Castiglione* (n.s.) **7**: 181-199.

Prévot, E. 1959. Morphologie et évolution des structures tentaculaires chez les Hydraires Gymnoblastes Capitata. *Recueil des travaux de la Station Marine d'Endoume* **29**: 91-126.

Ralph, P. M. 1953. A guide to the athecate (Gymnoblastic) hydroids and medusae of New Zealand. *Tuatara* **5**: 59-75.

Ramil, F., and Vervoort, W. 1992. Report on the hydroids collected by the "BALGIM" expedition in and around the Strait of Gibraltar. *Zoologische Verhandelingen* **277**: 1-262.

Rees W. J., and Vervoort, W. 1987. Hydroids from the John Murray Expedition to the Indian Ocean, with revisory notes on *Hydrodendron, Abietinella, Cryptolaria* and *Zygophylax* (Cnidaria: Hydrozoa). *Zoologische Verhandelingen* **237**: 1-209.

Ritchie, J. 1907. The hydroids of the Scottish National Antarctic Expedition. *Transactions of the Royal Society of Edinburgh* **45**: 519-545.

Rossi, L. 1961. Idroidi viventi sulle scogliere del promontorio di Portofino (Golfo di Genova). *Annali di Museo Civico del Storia Naturale di Genova* **72**: 69-85.

Rotch, W. D. 1871. On a new genus and species of hydroid zoophyte. *Annals and Magazine of Natural History* **7**(4): 227-228.

Schuchert, P. 1996. The marine fauna of New Zealand: Athecate hydroids and their medusae (Cnidaria: Hydrozoa). *New Zealand Oceanographic Institute Memoir* **16**, 1-159.

Stechow, E. 1909. Beiträge zur Naturgeschichte Ostasiens: Hydroidpolypen der japanischen Ostküste. 1. Teil. Athecata und Plumularidae. *Abhandlungen der Mathematisch Physikalischen Klasse der Königlichen Bayerischen Akademie der Wissenschaften* (Suppl.) **1**(6): 1-111.

Stechow, E. 1913. Hydroidpolypen der Japanischen Ostküste. 2 Teil. Campanularidae, Haleeidae, Lafocidae, Campanulinidae und Sertularidae, nebst Ergänzungen zu den Athecata und Plumularidae. *Abhandlungen der Mathematisch-Physikalischen Klasse der Königlichen Bayerischen Akademie der Wissenschaften* (Suppl.) **3**(2): 1-162.

Stechow, E. 1923. Die Hydroidenfauna der Japanischen Region. *Journal of the College of Sciences, Imperial University of Tokyo* **44**(8): 1-23.

Stechow, E. 1924. Diagnosen neuer Hydroiden aus Australien. *Zoologischer Anzeiger* **59**: 57-69.

Stechow, E. 1925. Hydroiden von West-und Südwestaustraliën nach den Sammlungen von Prof. Dr. Michaelsen und Prof. Dr. Hartmeyer. *Zoologische Jahrbücher* **50**: 191-269.

Stechow, E., and Müller, H. C. 1923. Hydroiden von den Aru-Inseln. *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft* **35**(4): 459-477.

Teissier, G. 1965. *Inventaire de la faune marine de Roscoff. Cnidaires et Ctenaires.* Station Biologique de Roscoff.

Thornely, L. R., 1904. Report on the Hydroida collected by Professor Herdman, at Ceylon, in 1902. *Ceylon Pearl Oyster Fisheries. Supplementary. Report* **8**: 107-126.

Thornely, L. R. 1908. Reports on the marine biology of the Sudanese Red Sea. 10. Hydroida collected by Mr. C. Crossland from October 1904 to May, 1905. *Journal of the Linnean Society* (Zoology) **31**: 80-85.

Trebilcock, R. E. 1928. Notes on New Zealand Hydroida. *Proceedings of the Royal Society of Victoria* **41**: 1- 31.

Vervoort, W. 1941. Biological results of the Snellius Expedition. XI. The Hydroida of the Snellius Expedition. (Milleporidae and Stylasteridae excluded). *Temminckia* **6**: 186-240.

Vervoort, W. 1946. Exotic hydroids in the collections of the Rijksmuseum van Natuurlijke Historie and the Zoological Museum at Amsterdam. *Zoologische Mededelingen* **26**: 287-351.

Vervoort, W. 1962. Redescription of *Solanderia gracilis* Duchassaing and Michelin, 1846, and general notes on the family Solanderiidae (Coelenterata: Hydrozoa) *Bulletin of Marine Science* **12**: 508-542.

Vervoort, W. 1966. Skeletal structure in the Solanderiidae and its bearing on hydroid classification In: The Cnidaria and their evolution. *Symposium of the Zoological Society of London* **16**: 373-396.

Vervoort, W. 1967. The Hydroida and Chondrophora of the Israel South Red Sea Expedition, 1962. *Bulletin of the Sea Fisheries Research Station Israel* **43**: 18-54.

Vervoort, W. and Vasseur, P. 1977. Hydroids from French Polynesia with notes on distribution and ecology. *Zoologische Verhandelingen* **159**: 1-98.

Watson, J. E. 1980. The identity of two tubularian hydroids from Australia with a description and observations on the reproduction of *Ralpharia magnifica* gen. et sp. nov. *Memoirs of the National Museum of Victoria* **41**: 53-63.

Watson, J. E. 1985. The genus *Eudendrium* (Hydrozoa: Hydroida) from Australia. *Proceedings of the Royal Society of Victoria* **97**(4): 179-221.

Watson, J. E. 1996. Distribution and biogeographic relationships of the hydroid fauna of the Australian west coast: a preliminary account. In: Piraino, S., Boero, F., Bouillon, J., Cornelius, P. F. S. and Gili, J. M. (eds). *Advances in Hydrozoan Biology. Scientia Marina* **60**(1): 75-83.

Yamada, M. 1959. Hydroid fauna of Japanese and adjacent waters. *Publications of the Akkeshi Marine Biological Station, Asamushi Tôhoku University* **13**(3-4): 241-245.

Accepted 1 November, 1999